CLAIMS

What is claimed is:

1. A method of operating a spread-spectrum-based wireless communication system to efficiently utilize spectrum in the presence of multipath, comprising:

dividing a stream of data-conveying symbols into a plurality of unspread substreams at a transmitter;

generating a common spreading code at said transmitter;

spreading, at said transmitter, each of said unspread substreams using said common spreading code to form a plurality of spread substreams;

combining, at said transmitter, said plurality of spread substreams to form a composite signal;

wirelessly transmitting, from said transmitter, a communication signal formed from said composite signal;

receiving said communication signal at a receiver; and

despreading said communication signal at said receiver using a mismatched filter to generate a baseband signal.

2. A method of operating a spread-spectrum-based communication system as claimed in claim 1 wherein said spreading activity comprises temporally offsetting application of said common spreading code to said plurality of unspread substreams so that said spread substreams correspond to said unspread substreams modulated by cyclic variations of said common code.

3. A method of operating a spread-spectrum-based communication system as claimed in claim 2 wherein:

said dividing activity produces successive blocks of symbols, where each block includes symbols concurrently present in each unspread substream, and each block has a block period; and

said temporally offsetting and combining activities are mutually configured so that for a portion of each block period said composite signal is responsive to symbols from two different blocks.

4. A method of operating a spread-spectrum-based communication system as claimed in claim 3 wherein said mismatched filter used in said despreading activity corresponds to a matched filter combined with a sidelobe suppression filter.

5. A method of operating a spread-spectrum-based communication system as claimed in claim 2 wherein:

said dividing activity produces successive blocks of symbols, where each block includes symbols concurrently present in each unspread substream; and

said temporally offsetting and combining activities are mutually configured so that said composite signal is responsive to symbols only from common blocks.

6. A method of operating a spread-spectrum-based communication system as claimed in claim 5 wherein:

said dividing and spreading activities produce M unspread substreams and M spread substreams, respectively, where M is an integer number;

said combining activity combines said M spread substreams so that, for each block, P of said M spread substreams occur

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first in said composite signal, where P is an integer number less than M;

said combining activity additionally comprises, for each block, repeating said P spread substreams so that said P spread substreams also occur last in said composite signal; and

said method additionally comprises, between said receiving and despreading activities, removing said first-occurring P spread substreams from said communication signal.

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7. A method of operating a spread-spectrum-based communication system as claimed in claim 6 additionally comprising applying block encoding to an input stream of data so that encoding blocks coincide with said successive blocks of symbols.

8. A method of operating a spread-spectrum-based communication system as claimed in claim 5 additionally comprising equalizing said communication signal at said receiver following said despreading activity using a maximum likelihood sequence estimation (MLSE) equalizer to compensate for multipath.

9. A method of operating a spread-spectrum-based communication system as claimed in claim 2 additionally comprising:

performing a first time-frequency domain transformation on said unspread substreams at said transmitter prior to said spreading activity; and

performing a second time-frequency domain transformation on said communication signal at said receiver prior to said despreading activity.

10. A method of operating a spread-spectrum-based communication system as claimed in claim 9 additionally comprising equalizing said communication signal at said receiver following said second time-frequency domain transformation using a frequency domain equalizer to compensate for multipath.

11. A method of operating a spread-spectrum-based communication system as claimed in claim 2 wherein said cyclic variations of said common code are applied to said unspread substreams as a matrix in a cyclic Toeplitz form.

12. A method of operating a spread-spectrum-based communication system as claimed in claim 1 wherein said common code is generated so that said mismatched filter exhibits a relative efficiency greater than 60% compared to a matched filter.

13. A method of operating a spread-spectrum-based communication system as claimed in claim 1 wherein said common code is generated so that a spectral analysis of said common code exhibits a substantially flat response.

14. A method of operating a spread-spectrum-based communication system as claimed in claim 1 wherein said receiver is a first receiver, said mismatched filter is a first mismatched filter, said baseband signal is a first baseband signal, and said method additionally comprises:

receiving said communication signal at a second receiver;

despreading said communication signal in said second receiver using a second mismatched filter to generate a second baseband signal;

generating said stream of data-conveying symbols as a time division multiple access (TDMA) stream having a plurality of time slots wherein a first one of said plurality of time slots is assigned to said first receiver and a second one of said plurality of time slots is assigned to said second receiver;

evaluating said first baseband signal at said first receiver to detect said first one of said time slots; and

evaluating said second baseband signal at said second receiver to detect said second one of said time slots.

15. A method of operating a spread-spectrum-based communication system as claimed in claim 14 wherein:

said transmitter is a first transmitter and said communication signal is a first communication signal, said first transmitter being configured so that said first communication signal substantially occupies a predetermined spectrum and said first communication signal is detectable throughout a first radio coverage area; and

said method additionally comprises transmitting a second communication signal from a second transmitter, said second communication signal substantially occupying said predetermined spectrum and being detectable throughout a second radio coverage area which is adjacent to said first radio coverage area.

16. A spread-spectrum-based communication system which efficiently utilizes spectrum in the presence of multipath, said communication system comprising:

a demultiplexer for dividing a stream of data-conveying symbols into a plurality of unspread substreams;

a spreading section coupled to said demultiplexer and configured to generate spread substreams from said plurality of unspread substreams, said spreading section being configured so that said spread substreams correspond to respective ones of said unspread substreams modulated by cyclic variations of a common spreading code;

a combining section coupled to said spreading section and configured to form a composite signal in response to said spread substreams;

a transmission section coupled to said combining section and configured to wirelessly transmit a communication signal formed from said composite signal;

a receiving section configured to receive said communication signal; and

a despreading section coupled to said receiving section, said despreading section being configured to generate a baseband signal in response to said communication signal.

17. A spread-spectrum-based communication system as claimed in claim 16 wherein said despreading section comprises a mismatched filter.

18. A spread-spectrum-based communication system as claimed in claim 17 wherein said spreading section and said mismatched filter of said despreading section are mutually configured so that said mismatched filter exhibits a relative efficiency greater than 60% compared to a matched filter.

19. A spread-spectrum-based communication system as claimed in claim 17 wherein:

said demultiplexer produces successive blocks of symbols, where each block includes symbols concurrently present in each unspread substream, and each block has a block period;

said spreading section is configured so that for a portion of each block period said composite signal is responsive to symbols from two different blocks; and

said mismatched filter corresponds to a matched filter combined with a sidelobe suppression filter.

20. A spread-spectrum-based communication system as claimed in claim 16 wherein said spreading section is configured so that a spectral analysis of said common code exhibits a substantially flat response.

21. A spread-spectrum-based communication system as claimed in claim 16 additionally comprising a time division multiple access (TDMA) modulation section coupled to said demultiplexer, said TDMA modulation section being configured so that said communication signal is a TDMA signal for which recipients are distinguished from one another by being assigned to different time slots.

22. A spread-spectrum-based communication system as claimed in claim 21 wherein:

said transmission section is a first transmission section, and said communication signal is a first communication signal;

said communication system has first and second adjacent radio coverage areas with said first communication signal

being transmitted to said first adjacent radio coverage area; and

said communication system additionally comprises a second transmission section configured to transmit a second communication signal to said second adjacent radio coverage area, said first and second communication signals being transmitted using a common spectrum.

23. A spread-spectrum-based communication system as claimed in claim 16 wherein:

said demultiplexer produces successive blocks of M symbols that concurrently influence said unspread substreams, where M is an integer number;

said spreading section is configured to produce M spread substreams, said M spread substreams being responsive to symbols only from common blocks;

said combining section is configured so that, for each block, P of said M spread substreams occur first in said composite signal, where P is an integer number less than M;

said combining section is further configured so that, for each block, said P spread substreams are repeated so that said P spread substreams also occur last in said composite signal; and

said communication system additionally comprises a cyclic prefix removal section coupled between said receiving and despreading sections for removing said first-occurring P spread substreams from said communication signal.

24. A spread-spectrum-based communication system as claimed in claim 16 additionally comprising a maximum likelihood sequence estimation (MLSE) equalizer coupled

downstream of said despreading section to compensate for multipath.

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25. A spread-spectrum-based communication system as claimed in claim 16 wherein:

said communication system additionally comprises a first time-frequency domain transformation section coupled between said demultiplexer and said spreading section;

said communication system additionally comprises a second time-frequency domain transformation section coupled between said receiver and said despreading section; and

said despreading section comprises a frequency domain equalizer to compensate for multipath.

26. A time division multiple access (TDMA), spread-spectrum-based communication system which efficiently utilizes spectrum in the presence of multipath, said communication system comprising:

a plurality of transmitters configured to wirelessly transmit TDMA communication signals which convey messages in adjacent radio coverage areas in accordance with a frequency reuse pattern substantially equal to one;

a plurality of receivers located in said adjacent radio coverage areas wherein each receiver is configured to detect ones of said messages intended for said each receiver by identifying time slots assigned to said each receiver;

wherein each of said transmitters comprises:

a demultiplexer for dividing a TDMA stream of data-conveying symbols into a plurality of unspread substreams;

a spreading section coupled to said demultiplexer and configured to generate spread substreams from said plurality of unspread substreams, said spreading section being configured so that said spread substreams correspond to respective ones of said unspread substreams modulated by cyclic variations of a common spreading code;

a combining section coupled to said spreading section and configured to form a composite signal in response to said spread substreams;

a transmission section coupled to said combining section and configured to transmit one of said TDMA communication signals formed from said composite signal; and

wherein each of said receivers comprises:

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a receiving section configured to receive one of said TDMA communication signals; and

a despreading section coupled to said receiving section, said despreading section being configured to generate a baseband signal in response to said TDMA communication signal.